WHAT IS CLAIMED IS:

1. A magnetic recording medium, comprising:

a disk substrate; and

a recording layer having magnetic anisotropy along a direction perpendicular to a surface of the disk substrate,

wherein the recording layer is formed so that a product of a coercive force Hc and saturated magnetization Ms of the recording layer (Ms·Hc) at room temperatures is increased sufficiently so that a shortest mark length of the recording layer can be decreased to a desired value.

2. The magnetic recording medium according to claim 1, wherein the product Ms·Hc of the coercive force Hc and the saturated magnetization Ms satisfies the following relationship:

$Ms \cdot Hc > 3 \times 10^6$ erg/cm^3.

3. The magnetic recording medium according to claim 1, further comprising:

a reproduction layer formed between the recording layer and the disk substrate for reproducing information recorded in the recording layer; and

an intermediate layer formed between the reproduction layer and the recording layer for controlling exchange coupling between the reproduction layer and the recording layer,

wherein the recorded information is thermomagnetically recorded as magnetic domains in the recording layer,

the magnetic domains are transcribed into the reproduction layer, and

a domain wall between the magnetic domains that are transcribed into the reproduction layer shifts along a direction parallel to a surface of the reproduction layer, so that the recorded information is reproduced.

4. The magnetic recording medium according to claim 1, wherein the shortest mark length of recording marks that correspond to a pattern of the recorded information formed in the recording layer is 0.2 μm or less.

5. The magnetic recording medium according to claim 1, wherein the

recording layer comprises at least Tb, Fe and Co or comprises a super–latticed structure.

6. The magnetic recording medium according to claim 5, wherein the Tb, Fe and Co contained in the recording layer are laminated periodically.

7. The magnetic recording medium according to claim 5, wherein the Tb, Fe and Co contained in the recording layer are laminated periodically with a thickness of 2 nm or less.

8. The magnetic recording medium according to claim 5, wherein, in the recording layer, layers of different materials or different composition rates are periodically laminated with each layer having a thickness of 2 nm or less.

9. The magnetic recording medium according to claim 5, wherein the recording layer is configured with periodic lamination of a layer of rare–earth rich composition and a layer of transition metal rich composition.

10. The magnetic recording medium according to claim 1, wherein the recording layer is formed on an under layer whose surface roughness Ra is at least 0.5 nm or more.

11. The magnetic recording medium according to claim 10, wherein a substrate, a dielectric layer or a magnetic layer is used as the under layer.

12. The magnetic recording medium according to claim 1, wherein the recording layer is formed by film deposition using an inert gas.

13. The magnetic recording medium according to claim 12, wherein the inert gas comprises at least one selected from Ne, Ar, Kr and Xe.

14. The magnetic recording medium according to claim 1, wherein the recording layer comprises at least one selected from Ne, Ar, Kr and Xe atoms.

15. The magnetic recording medium according to claim 1, wherein a size

of magnetic domains formed in the recording layer is 0.5 μm or less.

16. The magnetic recording medium according to claim 1, wherein, on the disk substrate, a pit–shaped pattern is formed corresponding to a pattern of magnetic domains formed in the recording layer.

17. The magnetic recording medium according to claim 1, wherein, on the disk substrate, a pit–shaped convexo-concave pattern is formed, the convexo–concavo pattern having a size smaller than that of the smallest pattern of magnetic domains formed in the recording layer.

18. A method for producing the magnetic recording medium according to claim 10, wherein a shape of a surface of the under layer for forming the recording layer thereon is changed by etching.

19. The method for producing a magnetic recording medium according to claim 18, wherein a substrate, a dielectric layer or a magnetic layer is used as the under layer.

20. The method for producing a magnetic recording medium according to claim 18, wherein the etching is dry etching including ion irradiation etching and plasma etching.

21. A method for producing the magnetic recording medium according to claim 3, wherein at the time of forming the recording layer, after a vacuum chamber is evacuated so that a degree of vacuum achieved in the vacuum chamber becomes 1×10^{-5} Pa or less, at least one selected from Ar gas, Ne gas, Kr gas and Xe gas is introduced into the vacuum chamber.

22. The method for producing a magnetic recording medium according to claim 21, wherein partial pressures of O_2, H_2O, N_2 and H_2 in the vacuum chamber at the time of forming the recording layer are 100 ppm or less with respect to a film deposition pressure.

23. The method for producing a magnetic recording medium according to claim 22, wherein the film deposition pressure for forming the recording film in the vacuum chamber ranges from 0.4 Pa to 6.0 Pa, inclusive.

24. The method for producing a magnetic recording medium according to claim 21, wherein a film deposition rate for forming the recording layer ranges from 0.5 nm/sec to 10 nm/sec, inclusive.

25. A magnetic recording/reproducing apparatus, comprising:

a recording unit provided for recording information in the recording layer that is formed in the magnetic recording medium according to claim 1; and

a reproducing unit for transcribing magnetic domains that are formed in the recording layer into a reproduction layer and for making a domain wall between the transcribed magnetic domains shift so as to reproduce the recorded information.

26. The magnetic recording/reproducing apparatus according to claim 25, wherein the reproducing unit expands the transcribed magnetic domains by forming a thermal gradient in the reproduction layer so as to reproduce the recorded information.

27. The magnetic recording/reproducing apparatus according to claim 25, wherein the reproducing unit expands the transcribed magnetic domains by applying a high-frequency magnetic field modulation from outside to the reproduction layer so as to reproduce the recorded information.